Introduction - Earth Science

The following released test questions are taken from the Earth Science Standards Test. This test is one of the California Standards Tests administered as part of the Standardized Testing and Reporting (STAR) Program under policies set by the State Board of Education.

All questions on the California Standards Tests are evaluated by committees of content experts, including teachers and administrators, to ensure their appropriateness for measuring the California academic content standards in Earth Science. In addition to content, all items are reviewed and approved to ensure their adherence to the principles of fairness and to ensure no bias exists with respect to characteristics such as gender, ethnicity, and language.

This document contains released test questions from the California Standards Test forms in 2003. First on the pages that follow are lists of the standards assessed on the Earth Science Test. Next are released test questions. Following the questions is a table that gives the correct answer for each question, the content standard that each question is measuring, and the year each question last appeared on the test. It should be noted that asterisked (*) standards are not assessed on the California Standards Tests in Science and, therefore, are not represented in these released test questions.

The following table lists each reporting cluster, the number of items that appear on the exam, and the number of released test questions that appear in this document. The released test questions for Biology, Chemistry, Earth Science, and Physics are the same test questions found in different combinations on the Integrated Science 1, 2, 3, and 4 tests.

Earth Science — Released Test Questions

REPORTING CLUSTER	NUMBER OF QUESTIONS ON EXAM	NUMBER OF RELEASED TEST QUESTIONS
Investigation and Experimentation (Standards: ESIE1. a-n)	6	1
Astronomy and Cosmology *Earth's Place in the Universe* (Standards: ES1. a-f, ES2. a-d)	12	3
Solid Earth *Dynamic Earth Processes* (Standards: ES3. a-e) *California Geology* (Standards: ES9. a-c)	14	3
The Earth's Energy *Energy in the Earth System* (Standards: ES4. a-c, ES5. a-e, ES6. a-c) *Biogeochemical Cycles* (Standards: ES7. a-c) *Structure and Composition of the Atmosphere* (Standards: ES8. a-c)	28	8
TOTAL	60	15

In selecting test questions for release, three criteria are used: (1) the questions adequately cover a selection of the academic content standards assessed on the Earth Science Test; (2) the questions demonstrate a range of difficulty; and (3) the questions present a variety of ways standards can be assessed. These released test questions do not reflect all of the ways the standards may be assessed. Released test questions will not appear on future tests.

For more information about the California Standards Tests, visit the California Department of Education's Web site at http://www.cde.ca.gov/statetests/star/ or http://www.cde.ca.gov/ta/tg/sr/resources.asp.

THE INVESTIGATION AND EXPERIMENTATION REPORTING CLUSTER

The following 14 California content standards are included in the Investigation and Experimentation reporting cluster and are represented in this booklet by one test question. This question represents only one way in which these standards may be assessed on the California Earth Science Standards Test.

CALIFORNIA CONTENT STANDARDS IN THIS REPORTING CLUSTER

Investigation and Experimentation	
ESIE1.	**Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three reporting clusters, students should develop their own questions and perform investigations. Students will:**
ESIE1. a.	Select and use appropriate tools and technology (such as computer-linked probes, spreadsheets, and graphing calculators) to perform tests, collect data, analyze relationships, and display data.
ESIE1. b.	Identify and communicate sources of unavoidable experimental error.
ESIE1. c.	Identify possible reasons for inconsistent results, such as sources of error or uncontrolled conditions.
ESIE1. d.	Formulate explanations by using logic and evidence.
ESIE1. e.	Solve scientific problems by using quadratic equations and simple trigonometric, exponential, and logarithmic functions.
ESIE1. f.	Distinguish between hypothesis and theory as scientific terms.
ESIE1. g.	Recognize the usefulness and limitations of models and theories as scientific representations of reality.
ESIE1. h.	Read and interpret topographic and geologic maps.
ESIE1. i.	Analyze the locations, sequences, or time intervals that are characteristic of natural phenomena (e.g., relative ages of rocks, locations of planets over time, and succession of species in an ecosystem).
ESIE1. j.	Recognize the issues of statistical variability and the need for controlled tests.
ESIE1. k.	Recognize the cumulative nature of scientific evidence.
ESIE1. l.	Analyze situations and solve problems that require combining and applying concepts from more than one area of science.
ESIE1. m.	Investigate a science-based societal issue by researching the literature, analyzing data, and communicating the findings. Examples of issues include irradiation of food, cloning of animals by somatic cell nuclear transfer, choice of energy sources, and land and water use decisions in California.
ESIE1. n.	Know that when an observation does not agree with an accepted scientific theory, the observation is sometimes mistaken or fraudulent (e.g., the Piltdown Man fossil or unidentified flying objects) and that the theory is sometimes wrong (e.g., the Ptolemaic model of the movement of the Sun, Moon, and planets).

THE ASTRONOMY AND COSMOLOGY REPORTING CLUSTER

The following 10 California content standards are included in the Astronomy and Cosmology reporting cluster and are represented in this booklet by three test questions. These questions represent only some ways in which these standards may be assessed on the California Earth Science Standards Test.

CALIFORNIA CONTENT STANDARDS IN THIS REPORTING CLUSTER

Earth's Place in the Universe	
ES1.	**Astronomy and planetary exploration reveal the solar system's structure, scale, and change over time. As a basis for understanding this concept:**
ES1. a.	*Students know* how the differences and similarities among the sun, the terrestrial planets, and the gas planets may have been established during the formation of the solar system.
ES1. b.	*Students know* the evidence from Earth and moon rocks indicates that the solar system was formed from a nebular cloud of dust and gas approximately 4.6 billion years ago.
ES1. c.	*Students know* the evidence from geological studies of Earth and other planets suggests that the early Earth was very different from Earth today.
ES1. d.	*Students know* the evidence indicating that the planets are much closer to Earth than the stars are.
ES1. e.	*Students know* the Sun is a typical star and is powered by nuclear reactions, primarily the fusion of hydrogen to form helium.
ES1. f.	*Students know* the evidence for the dramatic effects that asteroid impacts have had in shaping the surface of planets and their moons and in mass extinctions of life on Earth.
ES2.	**Earth-based and space-based astronomy reveal the structure, scale, and changes in stars, galaxies, and the universe over time. As a basis for understanding this concept:**
ES2. a.	*Students know* the solar system is located in an outer edge of the disc-shaped Milky Way galaxy, which spans 100,000 light years.
ES2. b.	*Students know* galaxies are made of billions of stars and comprise most of the visible mass of the universe.
ES2. c.	*Students know* the evidence indicating that all elements with an atomic number greater than that of lithium have been formed by nuclear fusion in stars.
ES2. d.	*Students know* that stars differ in their life cycles and that visual, radio, and X-ray telescopes may be used to collect data that reveal those differences.

THE SOLID EARTH REPORTING CLUSTER

The following eight California content standards are included in the Solid Earth reporting cluster and are represented in this booklet by three test questions. These questions represent only some ways in which these standards may be assessed on the California Earth Science Standards Test.

CALIFORNIA CONTENT STANDARDS IN THIS REPORTING CLUSTER

Dynamic Earth Processes	
ES3.	**Plate tectonics operating over geologic time has changed the patterns of land, sea, and mountains on Earth's surface. As the basis for understanding this concept:**
ES3. a.	*Students know* features of the ocean floor (magnetic patterns, age, and sea-floor topography) provide evidence of plate tectonics.
ES3. b.	*Students know* the principal structures that form at the three different kinds of plate boundaries.
ES3. c.	*Students know* how to explain the properties of rocks based on the physical and chemical conditions in which they formed, including plate tectonic processes.
ES3. d.	*Students know* why and how earthquakes occur and the scales used to measure their intensity and magnitude.
ES3. e.	*Students know* there are two kinds of volcanoes: one kind with violent eruptions producing steep slopes and the other kind with voluminous lava flows producing gentle slopes.
California Geology	
ES9.	**The geology of California underlies the state's wealth of natural resources as well as its natural hazards. As a basis for understanding this concept:**
ES9. a.	*Students know* the resources of major economic importance in California and their relation to California's geology.
ES9. b.	*Students know* the principal natural hazards in different California regions and the geologic basis of those hazards.
ES9. c.	*Students know* the importance of water to society, the origins of California's fresh water, and the relationship between supply and need.

THE EARTH'S ENERGY REPORTING CLUSTER

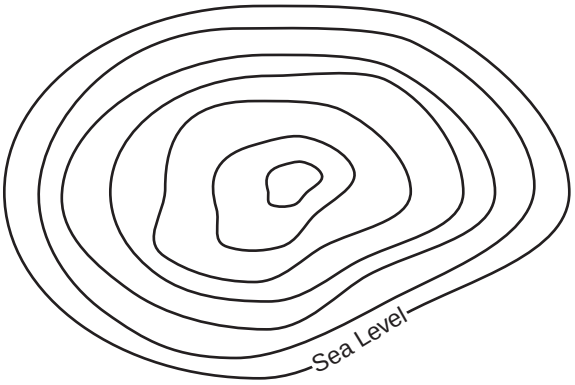
The following 17 California content standards are included in The Earth's Energy reporting cluster and are represented in this booklet by eight test questions. These questions represent only some ways in which these standards may be assessed on the California Earth Science Standards Test.

CALIFORNIA CONTENT STANDARDS IN THIS REPORTING CLUSTER

Energy in the Earth System	
ES4.	**Energy enters the Earth system primarily as solar radiation and eventually escapes as heat. As a basis for understanding this concept:**
ES4. a.	*Students know* the relative amount of incoming solar energy compared with Earth's internal energy and the energy used by society.
ES4. b.	*Students know* the fate of incoming solar radiation in terms of reflection, absorption, and photosynthesis.
ES4. c.	*Students know* the different atmospheric gases that absorb the Earth's thermal radiation and the mechanism and significance of the greenhouse effect.
ES5.	**Heating of Earth's surface and atmosphere by the sun drives convection within the atmosphere and oceans, producing winds and ocean currents. As a basis for understanding this concept:**
ES5. a.	*Students know* how differential heating of Earth results in circulation patterns in the atmosphere and oceans that globally distribute the heat.
ES5. b.	*Students know* the relationship between the rotation of Earth and the circular motions of ocean currents and air in pressure centers.
ES5. c.	*Students know* the origin and effects of temperature inversions.
ES5. d.	*Students know* properties of ocean water, such as temperature and salinity, can be used to explain the layered structure of the oceans, the generation of horizontal and vertical ocean currents, and the geographic distribution of marine organisms.
ES5. e.	*Students know* rain forests and deserts on Earth are distributed in bands at specific latitudes.
ES6.	**Climate is the long-term average of a region's weather and depends on many factors. As a basis for understanding this concept:**
ES6. a.	*Students know* weather (in the short run) and climate (in the long run) involve the transfer of energy into and out of the atmosphere.
ES6. b.	*Students know* the effects on climate of latitude, elevation, topography, and proximity to large bodies of water and cold or warm ocean currents.
ES6. c.	*Students know* how Earth's climate has changed over time, corresponding to changes in Earth's geography, atmospheric composition, and other factors, such as solar radiation and plate movement.

Biogeochemical Cycles	
ES7.	**Each element on Earth moves among reservoirs, which exist in the solid earth, in oceans, in the atmosphere, and within and among organisms as part of biogeochemical cycles. As a basis for understanding this concept:**
ES7. a.	*Students know* the carbon cycle of photosynthesis and respiration and the nitrogen cycle.
ES7. b.	*Students know* the global carbon cycle: the different physical and chemical forms of carbon in the atmosphere, oceans, biomass, fossil fuels, and the movement of carbon among these reservoirs.
ES7. c.	*Students know* the movement of matter among reservoirs is driven by Earth's internal and external sources of energy.
Structure and Composition of the Atmosphere	
ES8.	**Life has changed Earth's atmosphere, and changes in the atmosphere affect conditions for life. As a basis for understanding this concept:**
ES8. a.	*Students know* the thermal structure and chemical composition of the atmosphere.
ES8. b.	*Students know* how the composition of Earth's atmosphere has evolved over geologic time and know the effect of outgassing, the variations of carbon dioxide concentration, and the origin of atmospheric oxygen.
ES8. c.	*Students know* the location of the ozone layer in the upper atmosphere, its role in absorbing ultraviolet radiation, and the way in which this layer varies both naturally and in response to human activities.

1



Contour Interval - 5 meters

The highest elevation on this topographic map can be no more than about

A 25 meters.

B 34 meters.

C 45 meters.

D 49 meters.

2

Which of the following is the *best* evidence that the Earth's continents were once in vastly different positions than they are today?

A Penguins are found only in the Southern Hemisphere.

B Fossils of tropical plants are found in Antarctica.

C Volcanoes encircle the Pacific Ocean.

D Major rivers form deltas from continental erosion.

3

What is the source of energy for the Sun?

A hydrogen fusion

B internal combustion

C nuclear fission of metals

D burning of solar gases

4

The Sun is an average yellow star in the Milky Way galaxy, which is described as

A a dwarf galaxy.

B a spiral galaxy.

C an elliptical galaxy.

D an irregular galaxy.

5

Earthquake vibrations are detected, measured, and recorded by instruments called

A sonargraphs.

B seismographs.

C Richter scales.

D magnetometers.

6

Which of the following provides evidence for plate tectonics?

A sea-floor topography

B ocean currents

C Coriolis effect

D atmospheric temperatures

7 **Which of the following energy sources is *most* likely to be abundant in California due to its position on a plate boundary?**

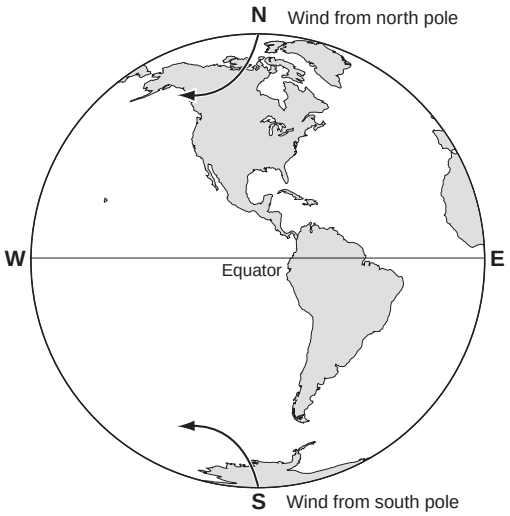
A wind

B nuclear

C solar

D geothermal

8



What causes the wind deflection from the north and south poles?

A rotation of the Earth on its axis

B the oblate shape of the Earth

C the tilt of the Earth's axis relative to its orbital plane

D the difference in total land mass of the two hemispheres

9 **Which of the following human activities reduces the level of ozone in the atmosphere?**

A using artificial lighting in scientific polar stations

B using large banks of solar cells for energy production

C releasing chlorofluorocarbons from aerosol cans

D destroying large areas of the equatorial rain forests

10

Analysis of Gases From a Hawaiian Volcano

Gas	Amount
H_2O (steam)	79%
CO_2	12%
SO_2	6.5%
N_2	1.5%
H_2, CO, Cl_2, and Ar	trace

The table above lists the gases coming from a modern Hawaiian volcano. If ancient volcanoes gave off the same gases, which gas would have been *most* helpful in the development of early life forms that could carry out photosynthesis?

A N_2

B SO_2

C CO_2

D Cl_2

11 **Shifts in the Earth's continents *most* likely caused a change in the Earth's**

A climatic regions.

B mass.

C orbital velocity.

D atmospheric temperature.

12 **The Moon is very hot on the side facing the Sun and very cold on the dark side. This extreme temperature difference is primarily due to the Moon's**

A mineral composition.

B thin atmosphere.

C reflective rocks.

D lack of volcanic activity.

13 **More solar energy reaches the equatorial regions than the polar regions because the equatorial regions**

A are covered by a greater area of land.

B have more vegetation to absorb sunlight.

C have days with more hours of light.

D receive sun rays closest to vertical.

14 **The Gulf Stream in the Northern Hemisphere and the Brazilian Current in the Southern Hemisphere move poleward. Compared to inland areas at the same latitude, the coastal areas bordering these currents will**

A be warmer.

B be more arid.

C have more advection fogs.

D have shorter growing seasons.

15 **The Earth's atmosphere is divided into layers that are based upon their**

A water content.

B relative humidity.

C gas content.

D temperature gradient.

Question Number	Correct Answer	Standard	Year of Test
1	*B*	ESIE1.H	2003
2	*B*	ES1.C	2003
3	*A*	ES1.E	2003
4	*B*	ES2.A	2003
5	*B*	ES3.D	2003
6	*A*	ES3.A	2003
7	*D*	ES9.A	2003
8	*A*	ES5.B	2003
9	*C*	ES8.C	2003
10	*C*	ES7.B	2003
11	*A*	ES6.B	2003
12	*B*	ES4.B	2003
13	*D*	ES5.A	2003
14	*A*	ES6.B	2003
15	*D*	ES8.A	2003